

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2) ...

From the INTERNATIONAL BUREAU

To:

Commissioner  
 US Department of Commerce  
 United States Patent and Trademark  
 Office, PCT  
 2011 South Clark Place Room 524  
 Arlington, VA 22202  
 ETATS-UNIS D'AMERIQUE  
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

<b>Date of mailing (day/month/year)</b> 27 October 2000 (27.10.00)	
<b>International application No.</b> PCT/US00/03682	<b>Applicant's or agent's file reference</b> 44114
<b>International filing date (day/month/year)</b> 11 February 2000 (11.02.00)	<b>Priority date (day/month/year)</b> 12 February 1999 (12.02.99)
<b>Applicant</b> FIBIGER, Richard, F. et al	

1. The designated Office is hereby notified of its election made:

☒

in the demand filed with the International Preliminary Examining Authority on:

14 August 2000 (14.08.00)

☐

in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was .☐

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<b>The International Bureau of WIPO</b> 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	<b>Authorized officer</b> H. Zhou Telephone No.: (41-22) 338.83.38
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## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>44114</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/US 00/ 03682</b>	International filing date (day/month/year) <b>11/02/2000</b>	(Earliest) Priority Date (day/month/year) <b>12/02/1999</b>
Applicant  <b>THE DOW CHEMICAL COMPANY et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of Invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. \_\_\_\_\_

☐ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

☐ None of the figures.

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/03682

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C08J9/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C08J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 717 000 A (SUH KYUNG W ET AL) 10 February 1998 (1998-02-10) cited in the application claims	1-20
A	US 5 164 460 A (OKADA AKANE ET AL) 17 November 1992 (1992-11-17) cited in the application claims	1-20



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

## \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&amp;" document member of the same patent family

Date of the actual completion of the international search

1 August 2000

Date of mailing of the international search report

18/08/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
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Authorized officer

Oudot, R

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/03682

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5717000 A	10-02-1998	AU 712100 B	28-10-1999
		AU 2132297 A	10-09-1997
		BR 9707867 A	27-07-1999
		CA 2247194 A	28-08-1997
		CN 1212001 A	24-03-1999
		CZ 9802639 A	13-01-1999
		EP 0882089 A	09-12-1998
		JP 2000505491 T	09-05-2000
		NO 983856 A	21-08-1998
		PL 328459 A	01-02-1999
		WO 9731053 A	28-08-1997
US 5164460 A	17-11-1992	JP 2872756 B	24-03-1999
		JP 4033955 A	05-02-1992
		DE 69111696 D	07-09-1995
		DE 69111696 T	25-01-1996
		EP 0459472 A	04-12-1991

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
17 August 2000 (17.08.2000)

PCT

(10) International Publication Number  
**WO 00/47657 A3**

- (51) International Patent Classification<sup>7</sup>: C08J 9/00
- (21) International Application Number: PCT/US00/03682
- (22) International Filing Date: 11 February 2000 (11.02.2000)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
60/119,816 12 February 1999 (12.02.1999) US
- (71) Applicant (for all designated States except US): **THE DOW CHEMICAL COMPANY** [US/US]; 2030 Dow Center, Midland, MI 48674 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **FIBIGER, Richard, F.** [US/US]; 3870 Johns Lane, Midland, MI 48642 (US). **SUH, Kyung, W.** [US/US]; 6204 Evergreen Court, Midland, MI 48642 (US). **BARGER, Mark, A.** [US/US]; 129 Helen Street, Midland, MI 48640 (US). **SCHOMAKER, Joseph, A.** [US/US]; 2280 South Duncan Road, Midland, MI 48640 (US). **LIANG, Wenbin** [CN/US]; 6319 Aspen Cove, Sugarland, TX 77479 (US). **MACKEY, George, A.** [US/US]; 6007 Oak Hollow Court, Midland, MI 48640 (US). **TUNG, Harvey, C.** [US/US]; 684 Carriage Court, Newark, OH 43055 (US).
- (74) Agent: **KORFHAGE, Glenn, H.**; The Dow Chemical Company, Intellectual Property Section, 2301 North Brazosport Boulevard, B-1211, Freeport, TX 77541-3257 (US).
- (81) Designated States (*national*): AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, YU, ZA, ZW.
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- Published:**  
— With international search report.
- (88) Date of publication of the international search report:  
18 January 2001
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: **NANOCOMPOSITE ARTICLES AND PROCESS FOR MAKING**

(57) **Abstract:** An improved process for making a structural foamed polymer, a multilayer polymer film, sheet or tube, a pultrusion polymer profile, a compression molded extruded fiber reinforced polymer pre-form, a strand foamed polymer and a SCORIM formed polymer article. The improvement includes the step of dispersing a multi-layered silicate material with the polymer so that the polymer has dispersed therein single layers of silicate material, double layers of silicate material, triple layers of silicate material, four layers of silicate material, five layers of silicate material and more than five layers of silicate material, the volume percent of the one, two, three, four and five layers of silicate material greater than the volume percent of the more than five layers of silicate material. In each of the above embodiments an important benefit of the instant invention is the orientation of the plane of the layers of silicate material. Preferably, most of the layers of silicate material have substantially the same orientation within thirty degrees of angle. Such orientation improves the properties of the product and provides a practical way to make larger products. The amount of multi-layered silicate material used is preferably between one and twenty percent.

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**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
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AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
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DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

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CLAIMS:

1. A process for making an article, the article comprising a nanocomposite polymer, the article selected from the group consisting of a structural foamed polymer, a multilayer polymer film, sheet or tube, a pultrusion structural profile, a compression molded polymer article formed from an extruded fiber reinforced polymer pre-form, a strand foamed polymer article and an article formed by the SCORIM process, comprising the steps of: dispersing a multi-layered silicate material with the polymer so that the polymer has dispersed therein single layers of silicate material, double layers of silicate material, triple layers of silicate material, four layers of silicate material, five layers of silicate material and more than five layers of silicate material, the volume percent of the one, two, three, four and five layers of silicate material being greater than the volume percent of the more than five layers of silicate material to form a nanocomposite polymer; the process characterized by the step of forming the nanocomposite article by flowing the nanocomposite polymer to align the planes of the one, two, three, four and five layers of silicate material so that more than one half of the planes have the same orientation within thirty degrees as determined by electron microscopy.

2. The process of Claim 1, wherein the article is a multilayer polymer film, sheet or tube and wherein the number of layers is ten or more.

3. The process of Claims 1-2, wherein the weight percent of the multi-layered silicate material dispersed in the polymer is in the range of from one to twenty percent.

4. The process of Claims 1-2, wherein the weight percent of the multi-layered silicate material dispersed in the polymer is in the range of from two to ten percent.

5. An article made by the process of Claims 1-4.

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## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference 44114	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US00/03682	International filing date (day/month/year) 11/02/2000	Priority date (day/month/year) 12/02/1999
International Patent Classification (IPC) or national classification and IPC C08J9/00		
Applicant THE DOW CHEMICAL COMPANY et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 4 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  14/08/2000	Date of completion of this report  23.05.2001
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Heidenhain, R  Telephone No. +49 89 2399 8673  

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US00/03682

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):  
**Description, pages:**

1-16 as originally filed

### Claims, No.:

1-5 as received on 15/02/2001 with letter of 15/02/2001

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☒ the claims, Nos.: 6-20
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/US00/03682

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	
	No: Claims	1-5
Inventive step (IS)	Yes: Claims	
	No: Claims	1-5
Industrial applicability (IA)	Yes: Claims	1-5
	No: Claims	

2. Citations and explanations  
**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/US00/03682

**R Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

Novelty: US-5 773 502 describes flame retardant compositions comprising a thermoplastic polyester and, based on said polyester, 5 to 20% of a halogenated organic fire retardant, 1 to 5%  $\text{Sb}_2\text{O}_3$ , 0.25 to 5% of an organo clay and 0.02 to 2% of a fluorocarbon polymer. Extruded articles are produced from these fire retardant compositions. Among the preferred organo clay materials utilized is Claytone HY<sup>R</sup>, that is the same material which is incorporated into the claimed nanocomposite polymer articles. From this it is to be concluded that the polymer in US5 773 502 also has dispersed therein single layers of silicate material, double layers, etc. Consequently the subject matter of claims 1-5 is to be regarded as lacking novelty over this prior art (Article 33,2 PCT).